The Veliger 39(3):189-203 (July 1, 1996)

THE VELIGER

Argentine Species of *Pisidium* Pfeiffer, 1821, and *Musculium* Link, 1807 (Bivalvia: Sphaeriidae)

by

CRISTIÁN F. ITUARTE

Department of Invertebrate Zoology, Museo de La Plata, 1900-La Plata, Buenos Aires, Argentina

Abstract. The Argentine Sphaeriidae (Mollusca, Bivalvia), in particular the Patagonian species, are reviewed. Seven species of *Pisidium* Pfeiffer, 1821, and two species of *Musculium* Link, 1807, have been recognized as distributed in east-central and southern Argentina.

Upon analysis of the type series of Pilsbry's Patagonian species, the original descriptions were improved and/or amended. Recent collections enlarged the known distributional ranges and allowed description of unknown features of soft-part anatomy, resulting in a more precise diagnosis of each species.

Pisidium ***inacayali,*** sp. nov. from Chubut Province (Patagonia) is described.

The presence of *Pisidium dorbignyi* Clessin, 1879, in Argentine inland waters is considered doubtful.

Cyclas paranensis d'Orbigny, 1846, quoted in the literature as a *Pisidium* species, actually belongs to the family Corbiculidae and corresponds to *Neocorbicula paranensis* (d'Orbigny, 1846).

After analysis of the type series of *Pisidium plenilunium* (Melvill & Standen, 1907), originally described in a marine genus and only known from a rather poor description, is here fully described and appropriately figured.

INTRODUCTION

Knowledge of the taxonomy, distribution, and biology of the Argentine representatives of the family Sphaeriidae, and particularly of the genera *Pisidium* Pfeiffer, 1821, and *Musculium* Link, 1807, is highly fragmentary and scanty.

The genus *Pisidium,* in our present knowledge, is represented in Argentina by seven species: *Pisidium sterkianum* Pilsbry, 1897, described from creeks in "el Prado," Montevideo, Uruguay; *Pisidium vile* Pilsbry, 1897, also described from creeks in "el Prado," Montevideo, Uruguay; *Pisidium magellanicum* (Dall, 1908), described from a single shell washed from some stream into the Magellan Strait; *Pisidium observationis* Pilsbry, 1911, from the "Monte Observación," south of the mouth of the Santa Cruz River, Province of Santa Cruz, Argentina; *Pisidium patagonicum* Pilsbry, 1911, from the Río Chico, Santa Cruz, Argentina; *Pisidium plenilunium* (Melvill & Standen, 1907) from Malvinas Islands; and *Pisidium dorbignyi* (Clessin, 1879) (*nomen novum pro Cyclas pulchella* d' Orbigny, 1835), described from the vicinity of Maldonado, Uruguay.

There are two known species of the genus *Musculium* in Argentina: *Musculium argentinum* (d' Orbigny, 1835), described from brooks in the vicinity of Montevideo Bay, Uruguay, and *Musculium patagonicum* Pilsbry, 1911, from springs along the Río Chico, Santa Cruz, Argentina.

Apart from all those original descriptions, further reports on Sphaeriidae species are rather scarce: Strobel (1874) reported *Musculium argentinum* from San Carlos (Mendoza), Bahía Blanca, and Carmen de Patagones (south of Buenos Aires Province); Olazarri (1983) reported *P. sterkianum* and *P. vile* from the environs of the Salto Grande Dam lake (Entre Rios); Fernandez & Schnack (1977) collected *P. sterkianum* from small brooks close to the Río de La Plata and, recently, Ituarte & Gordillo (1991) reported the presence of *P. observationis* and *Musculium patagonicum* at Isla Gable, Tierra del Fuego.

In a large number of ecological investigations on water courses and reservoirs along the Paraná and Uruguay River basins, the genus *Pisidium* (without species identification) has been reported as a relevant component of benthic associations (for a review see: Bonetto & Tassara, 1987). It must be noted that in none of them have *Musculium* species been reported.

The present paper focuses on the Sphaeriidae of east-central and southern Argentina, particularly on Patagonian species. The descriptions of known species of *Musculium* and *Pisidium* are enlarged and/or amended, and

new data on soft-part anatomy are given. On the basis of museum collections and personal samplings on Patagonian water courses, the geographical distribution for each species is updated. A new species of *Pisidium* from Chubut Province is described.

MATERIALS AND METHODS

The present review of the genera *Pisidium* and *Musculium* in Argentina was undertaken upon the study of collections at the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN), Museo de La Plata (MLP), and personal samplings which were deposited in the latter institution. The comparative study of the Patagonian species was made possible by the Academy of Natural Sciences of Philadelphia (ANSP) which provided most of the lots (including type series) collected by Dr. J. B. Hatcher (Princeton University expedition to Patagonia, 1896) and previously studied by H. A. Pilsbry. The study and description of the syntypes of *Pisidium plenilunium* was made possible by the cooperation of the Royal Museum of Scotland (RMS).

In the case of the collections made by the author, prior to fixation with 10% formalin (24 hr) and further preservation in 80% ethanol, specimens were relaxed by immersion in warm water (approx. 50°C) for a few minutes. Samples to be studied under scanning electron microscope were treated with a commercial sodium hypochlorite solution in order to eliminate soft parts, ligament, and periostracum adhering to shells. The specimens were then rinsed in distilled water, dried at room temperature, and coated with gold in a sputter coating unit.

Length measurements were taken with a Wild M_8 stereoscopic microscope provided with a micrometer eyepiece according to the following criteria: shell length (SL): maximum distance between the anterior and posterior margins parallel to the antero-posterior axis; shell height (H): maximum distance between dorsal and ventral margins, perpendicular to the antero-posterior axis; diameter (d): maximum distance across the valves. Shape indices based on shell measurements were calculated according to the following criteria (slightly modified from Holopainen & Kuiper, 1982; and Kuiper, 1983): Height index (I H/SL): percentage proportion of the height (H) over the shell length (SL); convexity index (Ci) or roundness: percentage proportion of the diameter (d) over the shell height (H); ratio hinge length and shell length (HiL/SL): distance between cusps of left anterior lateral (A_2) and left posterior lateral (P_2) as percentage of the shell length; pre-siphonal suture (PSS): distance between the base of the siphonal aperture (anal or branchial, according to the number of siphons the species have) and the origin of the pedal aperture; ligament-length index (Li): measured from the length of the ligamental pit and expressed as percentage of the shell length; and beak position: calculated as the percentage of the shell length left forward a perpendicular line that intercepts the central point of the beak and the antero-posterior axis.

RESULTS

Pisidium sterkianum Pilsbry

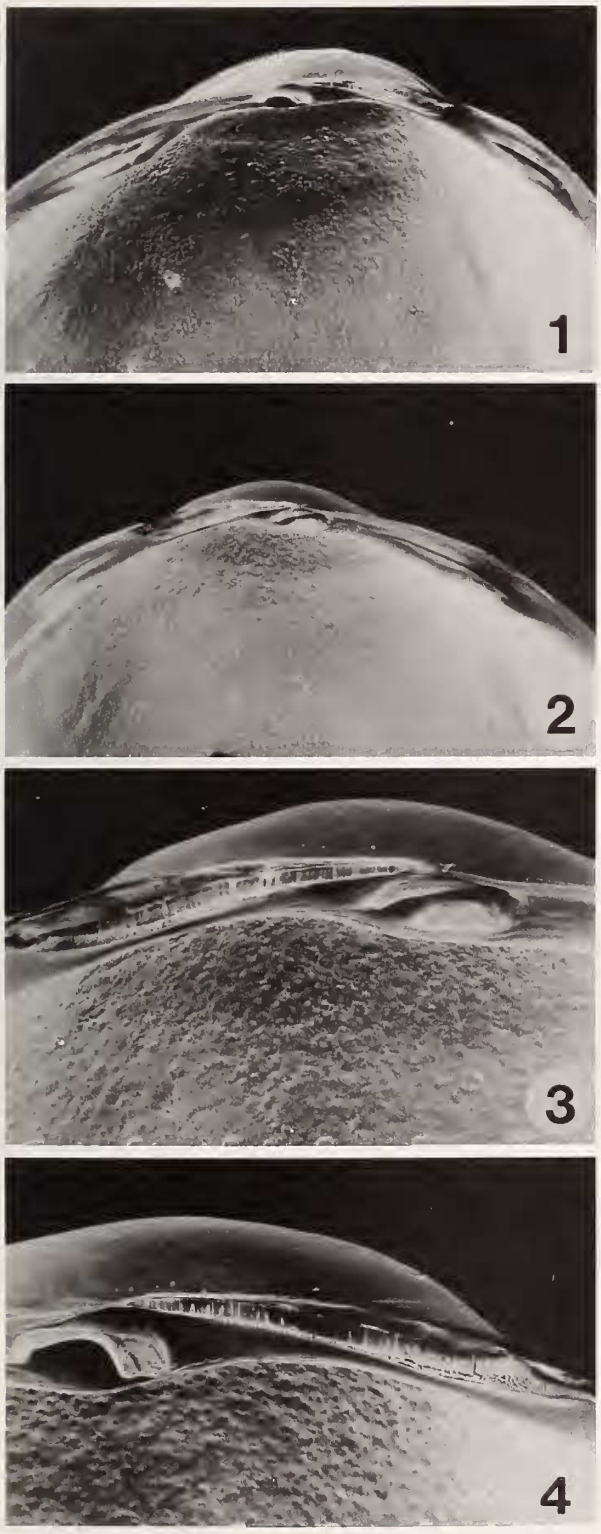
(Figures 1–4, 24)

Pisidium sterkianum Pilsbry, 1897:291, pl. 6, figs. 1–4.

Description: Shell inequilateral, medium to large, somewhat inflated (average I H/SL = 81.9 ± 1.8; average Ci = 69.3 ± 5.4). Surface glossy, straw-yellowish, and finely striated. Shell outline rounded-oval. Anterior end moderately produced; in certain specimens a slight but well-defined angle with the dorsal margin particularly evident. Posterior end decidedly truncate. Posterior margin broadly rounded or nearly straight. Anterior margin produced and obliquely rounded. Dorsal margin faintly curved and slightly concave in middle, just below beak. Dorsal and ventral margins about equally arcuate. Beak rather full but low and wide, not strikingly differentiated from shell surface or produced above dorsal margin; somewhat backwardly displaced (beak position: 53.1–64.7% of SL, average: 59.5%). Ligament extending from cardinal teeth to slightly beyond intersecting line of umbo with dorsal margin. From its origin, ligament inserting along a ridge at base of ligamental pit, being rather extroverted but not protruding from shell surface (average Li = 18.8 ± 2.7). Ligamental pit relatively long and slender, broadening out to posterior half.

Hinge plate solid. Hinge line broadly arcuated, strikingly narrowed behind cardinals (HiL/SL = 58 ± 2.7). Teeth well developed. In right valve: one cardinal tooth with anterior half straight or slightly arcuated, posteriorly thickened and deeply sulcated. Lateral walls of enlarged posterior end of C_3 sometimes appearing rugose due to presence of small circular hollows. Cardinal tooth arising from widest point of hinge plate. Lateral teeth arising just below intersection point of beak line with dorsal margin. Anterior and posterior lateral teeth solid, nearly straight and parallel. Inner posterior lateral (P_I) low, with nearly central cusp; P_{III} somewhat reduced, with distal cusps. Anterior laterals (A_I and A_{III}) with somewhat distally displaced cusps, A_{III} reduced when compared with A_I. Inner surface of laterals rugose. Left valve with two cardinal teeth, outer (C_4) just below central point of beak, slightly curved and oblique with respect to antero-posterior shell axis, overlapping C_2 at posterior half or a bit more. Inner cardinal (C_2) shorter, robust, broad at base and sharply curved at tip, displaced forward with respect to C_4 and parallel to antero-posterior axis. Left laterals strong, nearly straight, anterior lateral (A_2) with long inner slope and very short outer slope, posterior lateral (P_2) with more central cusp.

Anatomy. Only inner demibranchs present, short reflected lamella not much longer than one-fourth to one-third of length of descending one. Outer demibranchs entirely absent. Branchial opening absent. Anal opening, a slit bordered by muscular sphincter which does not extend into a siphon. Pre-siphonal suture relatively short (average PSS = 10.4 ± 2.7).



Figures 1–4

Pisidium sterkianum (MLP 5061). Figures 1, 4. Right valve, note the different shape of C_3 in Figure 4. Figures 2, 3. Left valve. Scale bars: Figures 1–2 = 2 mm; Figures 3–4 = 200 μm.

Variability. The solidness of the hinge plate may vary greatly. The anterior half of the right cardinal tooth may be in some individuals strongly arcuated (Figures 3, 4) and, in these cases, C_2 and C_4 are shorter, curved, and very close to one another, as shown in Figure 3.

Remarks: *P. sterkianum* is similar to *P. forense* Meier-Brook, 1967 (from Minas Gerais, Brazil), from which it differs in being larger, proportionally lower, and less globose. Moreover, the ligament is more decidedly extroverted in *P. sterkianum,* and the beak is less prominent.

In Kuiper's (1983, 1991) opinion, *P. gundlachi* Arango, 1865, and *P. consanguineum* Prime, 1865 (both from Cuba), may be considered synonymous with *P. sterkianum.*

Type locality: "el Prado," Montevideo, Uruguay.

Other localities: Several water courses that flow to the Uruguay River at Salto Grande Dam area, Concordia, Entre Rios (Olazarri, 1983); brooks and artificial channels flowing to the Río de La Plata: arroyo Miguelín, Ensenada, Buenos Aires (MLP 5058, 5059, 5061); Río Santiago, Ensenada, Buenos Aires (MLP 5060)).

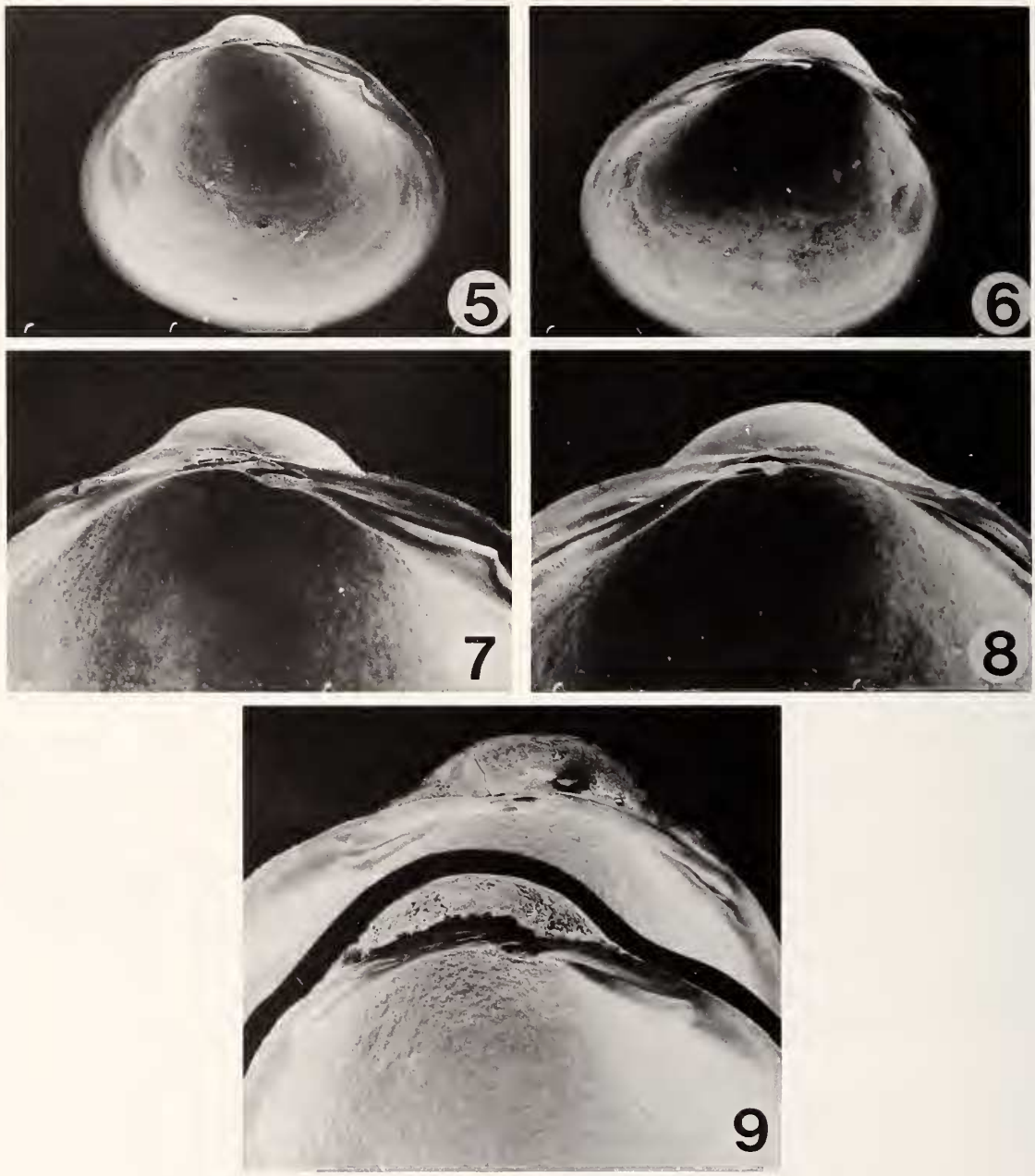
Pisidium vile Pilsbry

(Figures 5–9, 25)

Pisidium vile Pilsbry, 1897:292, pl.6, figs. 17–20.

Description: Shell small (maximum observed size: 3.4 mm), rather inequilateral, high, quite globose (average I H/SL = 89.2 ± 2.3; average Ci = 82.3 ± 4.6). Surface glossy, finely striated, white to pale yellowish; three or four concentric dark lines often well marked. Umbonal region frequently covered by sediments, forming thick crust masking external shell outline. Beak full, projecting above the dorsal margin and backward displaced (located at about 60% of shell length).

Posterior margin abruptly truncated, evenly curved or nearly straight. Anterior margin produced, oblique, and rounded. Dorsal margin rather short, about as strongly curved as ventral one. Hinge plate long, average HiL/SL = 55.7% ± 1.6) of shell length. Hinge plate sharply arcuate and narrow; cardinal teeth seeming to hang from dorsal margin. Hinge teeth well developed. In right valve, one cardinal tooth short, straight, or slightly curved, thickened and angled at its posterior end, forming a small weakly sulcated head. Anterior lateral teeth arising very close to cardinal ones. Inner anterior lateral (A_I) strong, wide, somewhat arcuated, with proximal slope long, distal slope relatively short. Outer anterior lateral (A_{III}) minute, nearly inconspicuous, narrow, straight, and displaced backward with respect to A_I. Posterior laterals delicate. Outer posterior lateral (P_{III}) short and straight, lower than P_I, and displaced forward. In left valve, one strong and large inner cardinal (C_2) and one outer cardinal (C_4) slender, straight, or evenly arcuate, very close to dorsal margin, overlapping C_2 at posterior end. Hinge plate very narrow at insertion of C_2, which seems to hang from its inner margin. Anterior lateral tooth strong, long, and straight, higher than P_2,



Figures 5–9

Pisidium vile (Figures 5–8: MLP 5062; Figure 9: MLP 5063). Figures 5 and 6. Interior view of left and right valves. Figures 7 and 8. Detail of hinge plates. Figure 9. Detail of beak covered by a thick crust of sediments. Scale bars = 2 mm.

with stippled cusp and long proximal slope; distal slope moderately short. Posterior lateral (P_2) rather short, as strongly curved as posterior margin, running very close to shell margin.

Ligament tending decidedly to be extroverted, inserting in a long and broad ligamental pit (average Li = 20.2% ± 1.4).

Anatomy. Only inner demibranchs present. Branchial opening absent. Pre-siphonal suture relatively short, representing about 8–12% of shell length (average 10.49%).

Remarks: *P. vile,* as stated in the original description, differs from *Pisidium dorbignyi* Clessin, 1879, in being smaller, shorter, with a much more projecting beak. In

Pilsbry's opinion, the very large size of the posterior left cardinal and the "greater reduction" of the anterior one, are conspicuous features.

Type locality: The species was described from a creek in "el Prado," Montevideo, Uruguay.

Other localities: Olazarri (1983) reported *P. vile* from the area of Salto Grande Dam lake (Entre Rios, Argentina; Salto, Uruguay). *P. vile* is a common species in water courses flowing to the Río de La Plata basin, frequently cohabiting with *P. sterkianum*. The studied specimens were dredged from "arroyo Miguelín" (MLP 5062) a small brook, and Río Santiago (MLP 5063), a moderately large stream, both at Ensenada, Buenos Aires.

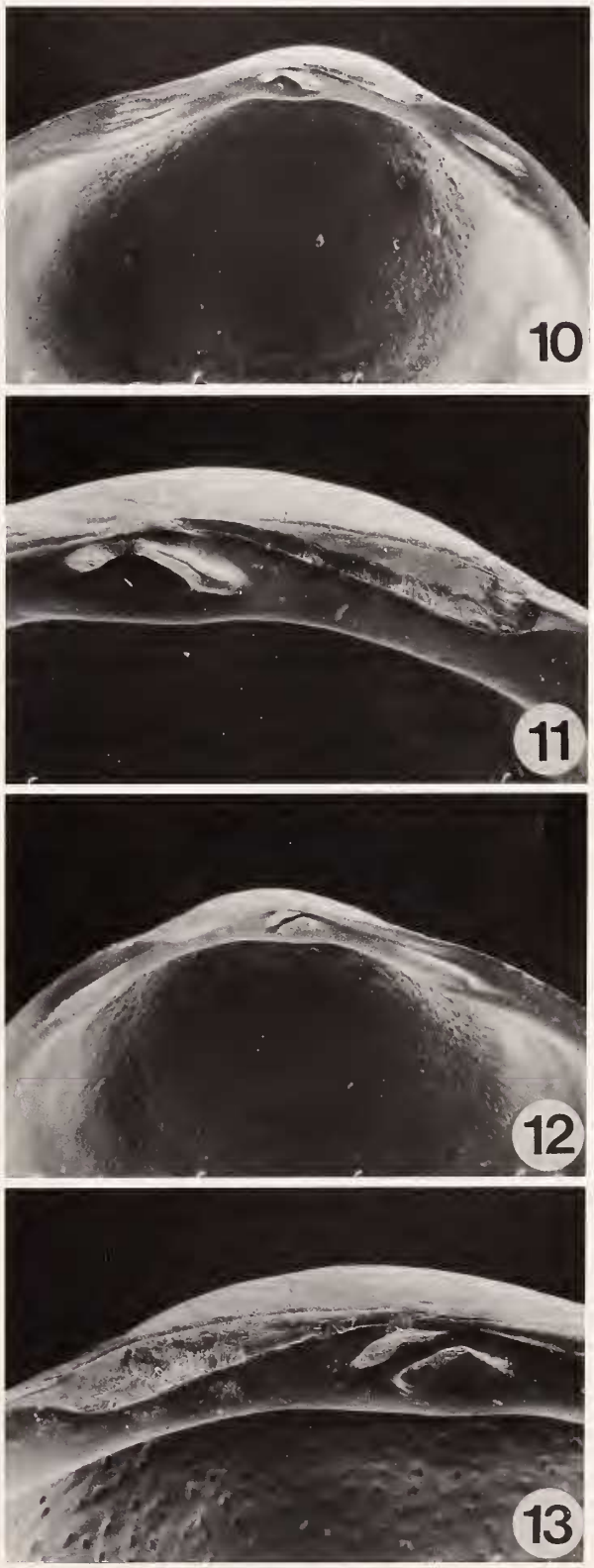
Pisidium magellanicum (Dall)

(Figures 10–13, 26)

Corneocyclas magellanicus Dall, 1908:411.
Pisidium magellanicum (Dall), Pilsbry, 1911:606, pl. 47, figs. 12–16.

Description: Species small to medium-sized, shell outline oval with antero-posterior axis rather enlarged, moderately inflated (average I H/SL = 80.5 ± 1.7; average Ci = 64.5 ± 3.7). Beak low and wide, not protruding, somewhat backwardly displaced (located at about 58% of the shell length). Posterior margin truncated, broadly rounded; anterior margin protruded, uniformly curved. Dorsal margin short, ventral margin broad, evenly arcuate. Shell surface polished, white-translucent. Shell surface sculptured with several resting-stage lines and fine concentric striation.

Hinge plate solid. Hinge line relatively long (HiL/SL about 54% of shell length). In left valve, two well-developed cardinal teeth. Inner cardinal tooth (C_2) strong, somewhat forward displaced; arising from a short and robust horizontal base, it twists at the apical end. Outer left cardinal (C_4) located exactly below central point of beak, oblique, overlapping C_2 at posterior half. C_4 short and slender, wedge-shaped, slightly arcuate. Lateral teeth arising just below intersection point of beak line with dorsal margin. Anterior lateral (A_{II}) triangular, with stippled distal cusp; posterior lateral (P_{II}) shorter, triangular, with nearly distal and blunt cusp. Right cardinal tooth (C_3) taking shape of wide inverted-V with posterior branch shorter, anterior branch slightly distally broadened, weakly sulcated. Anterior lateral teeth: A_{III} minute, cusp displaced backward with respect to cusp of inner one (A_I). Posterior lateral teeth strong, straight, shorter than anterior ones; P_I reduced, cusp quite distal. Inner surfaces of right lateral



→

Figures 10–13

Pisidium magellanicum (MLP 5064). Figure 10. Right valve. Figure 11. Detail of C_3 and ligament. Figure 12. Left valve. Figure 13. detail of cardinal teeth and ligament of the left valve. Scale bars = 1 mm.

teeth rugose. Divergence angle between laterals varied from 122 to 125°.

Ligament internal, strong, relatively short and broad (ligament length about 17% of shell length); ligamental pit deep.

Anatomy. Outer and inner demibranchs present. Inner demibranchs well developed, shorter ascending lamella covering approximately one-third to one-fourth of descending ones. Outer demibranchs relictual, represented by a few short filaments close to posterior adductors. Both siphonal openings present (also observed on dry soft parts of individuals of ANSP lot 88811). Anal opening bordered by well-developed muscular ring, much reduced in branchial one. Inhalant and exhalant currents internally separated by pallial fold which forms horizontal septum between anal and branchial openings. Pre-siphonal suture short, representing about 5–10% (average: 7.7%) of shell length.

Type locality: Magellan Strait in 61 fathoms, "Albatross" station no. 2778 (the species was described upon a single valve washed into the sea from a stream in the continent).

Other localities: Pilsbry (1911) found *Pisidium magellanicum* ". . . in several springs a long the Río Chico, 15 miles (ANSP 88812, examined lot) and 25 miles above the Sierra Oveja (today known as "cerro Las Ovejas"), 48°46'S, 70°22'W; Río Blanco near the base of the Andes; and springs at the base of the Andes, 65 miles north of the Río Chico, 2400 ft. elevation (ANSP 88811, examined lot) . . ."; all sample sites mentioned above are at the Santa Cruz province. *Pisidium magellanicum* has been collected by the author from an unnamed brook, 3 km distance from Trevelin to Futaleufú hydroelectric power plant (Amutui-Quimei Lake), Chubut Province (MLP 5064).

Remarks: Following the original description in 1908 and later citation by Pilsbry in 1911, the species has never been reported until the present study. The specimens studied by Pilsbry (1911) from Río Chico (15 miles above Sierra Oveja) seem to be lower and with more prominent beaks than figured in his paper. The specimens of the lot ANSP 88811 (from the bottom of the Andes, 65 miles north to Río Chico) fit better with the original decription and with the specimens from Trevelin, Chubut, here described and figured.

Pisidium observationis Pilsbry

(Figures 14–19, 27)

Pisidium observationis Pilsbry, 1911:608, text fig. 19.

Description: Shell rather inequilateral, high, somewhat inflated (average I H/SL = 87.2 ± 2.3; average Ci = 60.3 ± 4.7). Shell outline rounded-ovate, posterior end decidedly truncated and widely arcuated; anterior end protruded in sharp curve. Shell surface glossy, straw-yellowish or pale brown. Several growth-arrest lines often well marked. Surface finely striated. Beak wide, low, not outstanding from shell surface, slightly visible above dorsal margin, located at about 57% of shell length. Dorsal margin short, slightly concave in middle. Ventral margin wide, evenly rounded.

Hinge plate solid, rather straight. Hinge length representing about 57% of shell length. Left cardinal teeth well developed. C_4 rather long, slender and low, slightly and evenly curved, nearly horizontal with respect to anteroposterior axis; overlapping C_2 at posterior end (Figure 17) or at both ends (Figure 18). C_2 shorter, more robust, slightly curved, sometimes oblique. External left cardinal (C_4) may appear as slightly sinuous. Lateral teeth not remote from cardinals, arising just below intersection of beak line with dorsal margin. A_2 and P_2 long, high, cusps distally displaced, blunt in P_2, stippled in A_2. Right cardinal tooth straight or slightly curved (somewhat distorted in cases), posterior end enlarged and sulcated, sometimes broadened in a small head. Right lateral teeth well developed, parallels. Inner anterior lateral (A_I) wide, broadly curved, cusp nearly central. Outer anterior lateral (A_{III}) straight, slender with distal cusp, shorter and lower than A_I. Posterior laterals: inner posterior lateral (P_I) long and low, slightly curved, cusp central or somewhat distal. Outer posterior lateral (P_{III}) shorter, straight, with distal cusp. Inner surface of laterals rugose. Divergence angle between lateral teeth ranging from 100 to 105°. Ligament internal; ligamental pit deep, curved at ventral margin, and evenly broadened to posterior end. Ligament length about 19% of shell length, surpassing a little the intersection point of beaks line with dorsal margin.

Anatomy. Anal aperture, only siphonal aperture present, a long slit. Pre-siphonal suture short, representing about 7 to 12% of shell length (average 9.3%) (pre-siphonal suture accessible for measurement in only five specimens). Analysis of dried soft parts of type series (ANSP lot 7799) permitted corroboration of the presence of a single siphonal aperture (only one specimen was available for measurement, PSS was 6.5% of SL). Only inner demibranchs present, ascending lamella half as long as descending one.

Remarks: *P. observationis* is the most distinctive species among the Patagonian Sphaeriidae described by Pilsbry in 1911. This species is easily distinguished from the rest of the Patagonian pisidia by the general shell outline, beak position, and hinge characteristics (particularly the morphology and position of the posterior right lateral teeth, which are long, slender, and parallel). The ligament length, the hinge-length ratio, and the short pre-siphonal suture distinguish *P. observationis* from other Patagonian species. In particular, the decidedly more internal ligament, the presence of only one siphonal aperture, only one branchial lamella, and the minor divergence angle of the lateral teeth are the main features that separate *P. observationis* from *P. magellanicum*.

Since the original description in 1911, *P. observationis* was only reported from Tierra del Fuego (Ituarte & Gor-

dillo, 1991). Morphometric ratios of the type series and specimens from Laguna Verde, Neuquén here studied are coincident. The maximum shell size reported by Pilsbry in the original description (5.1 mm) exeeds the maximum sizes measured in the type-series lot (ANSP lot 7799), but that value is in agreement with the maximum size computed in the present study (5.2 mm) for specimens from Laguna Verde, Neuquén.

Type locality: ". . . near the Mount of Observation (below the mouth of Santa Cruz River) . . .", today known as cerro Observación (50°22'S; 68°57'W), near "cañadón de las Vacas", department of Corpen Aike, Santa Cruz Province (ANSP 7799, examined lot).

Other localities: Laguna Verde (1600 m elevation), Cerro Chapelco, San Martín de los Andes, in the province of Neuquén (MLP 5065); Isla Gable, Tierra del Fuego (MLP 4988).

Pisidium patagonicum Pilsbry

(Figure 28)

Pisidium patagonicum Pilsbry, 1911:607, pl.17, figs. 8–10.

This species has not been found or reported since the original description by Pilsbry (1911). The original description follows:

". . . The shell is pale buff, glossy, very finely striate, with low, wide, smooth and glossy beaks; strongly inequilateral, the anterior end very short and rounded, base evenly convex, posterior end narrow and somewhat produced. Interior white. Cardinal teeth are excessively weak and low, nearly effaced. There is a very low, horizontal, rudimentary tooth in the right valve, a low short one in the left, with the scarcely discernible trace of another anterior to it. . . . Lateral teeth very short and moderately strong, distant from the beaks. . ."

Remarks on the type-series: (ANSP 88810). Shell moderately inflated, high (average I H/SL = 91.6 ± 1.6; average Ci = 63.9 ± 2.6). Shell outline rounded-oval, with posterior end bluntly truncate. Dorsal margin very short, uniformly arcuate; ventral margin wide, evenly curved; anterior end protruded, sharply curved. Beak central, moderately low and wide, somewhat protruding and readily visible above dorsal margin (located at about 54% of shell length). Hinge plate solid, sharply arcuate, relatively long (average HiL/SL = 58.5%). Strong ligament, broad and relatively long (ligament length is about 14.9% of shell length), located in a well-marked ligamental pit, and not

→

Figures 14–17

Pisidium observationis (MLP 5065). Figure 14. Hinge of the right valve. Figure 15. Detail of cardinal tooth and ligament. Figure 15. Hinge of the left valve. Figure 16. Detail of the cardinal teeth and ligament. Scale bars = 1 mm.

Figures 18 and 19

Pisidium observationis (MLP 5065), a second type of tooth arrangement. Figure 18. Detail of the left cardinal teeth showing C_4 overlapping C_2 at both ends. Figure 19. Right cardinal tooth (C_3) slightly curved, somewhat distorted and deeply sulcated. Scale bars = 1 mm.

discernible from exterior. Contrary to Pilsbry's original description, cardinal teeth seem to be rather well defined. Right valve: outer cardinal, C_4, slender, evenly curved, oblique and placed rather close to inferior margin of ligamental pit, not overlapping C_2. Inner cardinal tooth, C_2, very short (nearly columnar in several specimens), low and perpendicular to hinge plate, arising from a broad and strong base. Right cardinal tooth (C_3) irregular in shape, slender and short, slightly concave in middle, not distally enlarged. At both sides of right cardinal tooth, two fossettes serve to articulate C_2 and C_4. These fossettes are not as well developed in any other *Pisidium* species from Patagonia. Right and left laterals well defined, relatively short, and remote from cardinals; divergence angle of lateral teeth is about 100°, quite different from divergence angle found in *P. magellanicum:* 112° in Pilsbry's text figure 18, to 125° in specimens from Trevelin, Chubut, but closer to divergence angle in *P. observationis* (about 100–105°). Ligament proportionally shorter than in *P. observationis*. *P. patagonicum* resembles *P. observationis* in shell shape; however, the latter is lower and somewhat less convex.

Type locality: A spring on the Río Chico, 15 miles north of Sierra Oveja (today known as "cerro Las Ovejas," 48°46'S; 70°22'W, Río Chico Department, Santa Cruz Province) (ANSP 88810, examined lot).

Other localities: Pilsbry (1911) reported the species from ". . . springs on the Río Chico thirty miles above the Sierra Oveja; twenty-five miles below the Río Belgrano; Arroyo Eke, near the head waters of the Spring Creek, 2400 ft. elevation. . ."

Pisidium ***inacayali*** Ituarte, sp. nov.

(Figures 20–23, 29)

Description: Species medium-sized, shell elongated and moderately convex (average I H/SL = 80.3 ± 1.4; average Ci = 61 ± 3.6); translucent, periostracum white to yellowish, evenly fine-striated. Shell outline oval, rather inequilateral. Anterior margin produced, evenly curved, posterior margin abruptely truncated, widely rounded. Dorsal margin arcuate backward to beak, with marked depression or concavity in middle, nearly straight forward of the beak. A slightly marked angle connecting dorsal margin with anterior margin. Ventral margin uniformly arcuate. Beak wide, extremely depressed, displaced backward, located at about 59% of shell length, only slightly visible above dorsal line.

Hinge plate solid. Hinge line rather long (about 58% of shell length). In right valve, one cardinal tooth slender, with anterior half curved and not as thickened at posterior end, which is sulcated. Anterior lateral teeth strong, A_I broadly curved with cusp somewhat displaced forward, A_{III} reduced, with distal cusp slightly displaced backward. Posterior laterals delicate, straight, and parallel. P_I with nearly central cusp, P_{III} shorter, with distal cusp. In left valve, two slender cardinals, C_4 slightly sinuous or weakly curved, oblique, overlapping C_2 at least at posterior half. C_2 shorter, higher, more arcuated than C_4. Lateral teeth robust, high, inner slopes longer than outer ones. Divergence angle of lateral teeth from 113 to 122°.

Ligament robust, long (about 20% of shell length), surpassing, sometimes greatly, the beak line at intersection with dorsal margin. Ligament internal, enclosed, closely applied to dorsal margin. Well-defined ligamental pit, with inner margin curved, broadened, and slightly angled in middle.

Anatomy. Only inner demibranchs present, descending lamella well developed, ascending one shorter (about one-third of former). Only one siphonal aperture, the anal, as long slit encircled by weakly muscular sphincter. Presiphonal suture long (about 14% of shell length). Adductor scars and pallial line well marked.

Remarks: *P.* ***inacayali*** is close to *P. magellanicum* in general shell shape; however, the new species is less convex, the beak is more backward displaced, and the ligament is stronger, larger, and also different in shape. The hinge

line length relative to shell length is larger in *P. inacayali.* The presiphonal suture is decidedly larger, in part because of the lack of the branchial opening. The right cardinal tooth morphology is also distinctive for each species. The new species differs from *P. observationis* in being much lower, with a much more depressed and backwardly displaced beak. The general shell shape is also distinctive, as well as the shape of the ligamental pit. The presiphonal suture is longer in *P. inacayali.*

Type locality: An unnamed brook, at 3 km on the road from Trevelin (43°04′S; 71°29′W) to Futaleufú River Dam, Chubut province, Argentina.

Other localities: *P. inacayali* was also collected from an unnamed brook, 6.5 km before Tecka (on the intersection with the national route No. 40), Chubut, Argentine.

Type specimens: Holotype: in the collection of the Department of Invertebrate Zoology, Museo de La Plata (MLP 5066); Paratypes: MLP 5067; 5068; Department of Invertebrates MACN 33761; Muséum National d'Histoire Naturélle (Paris).

Etymology: The species is named in honor of Inacayal, one of the last Patagonian Indian Chiefs who surrendered at the end of the "Desert Campaign." Inacayal lived in the Tecka neighborhoods and spent the last years of his life at the Museum of La Plata where he died in 1888. His remains were repatriated in 1994.

Pisidium Species Formerly Quoted in Marine Genera:

Pisidium plenilunium (Melvill & Standen)

(Figure 30)

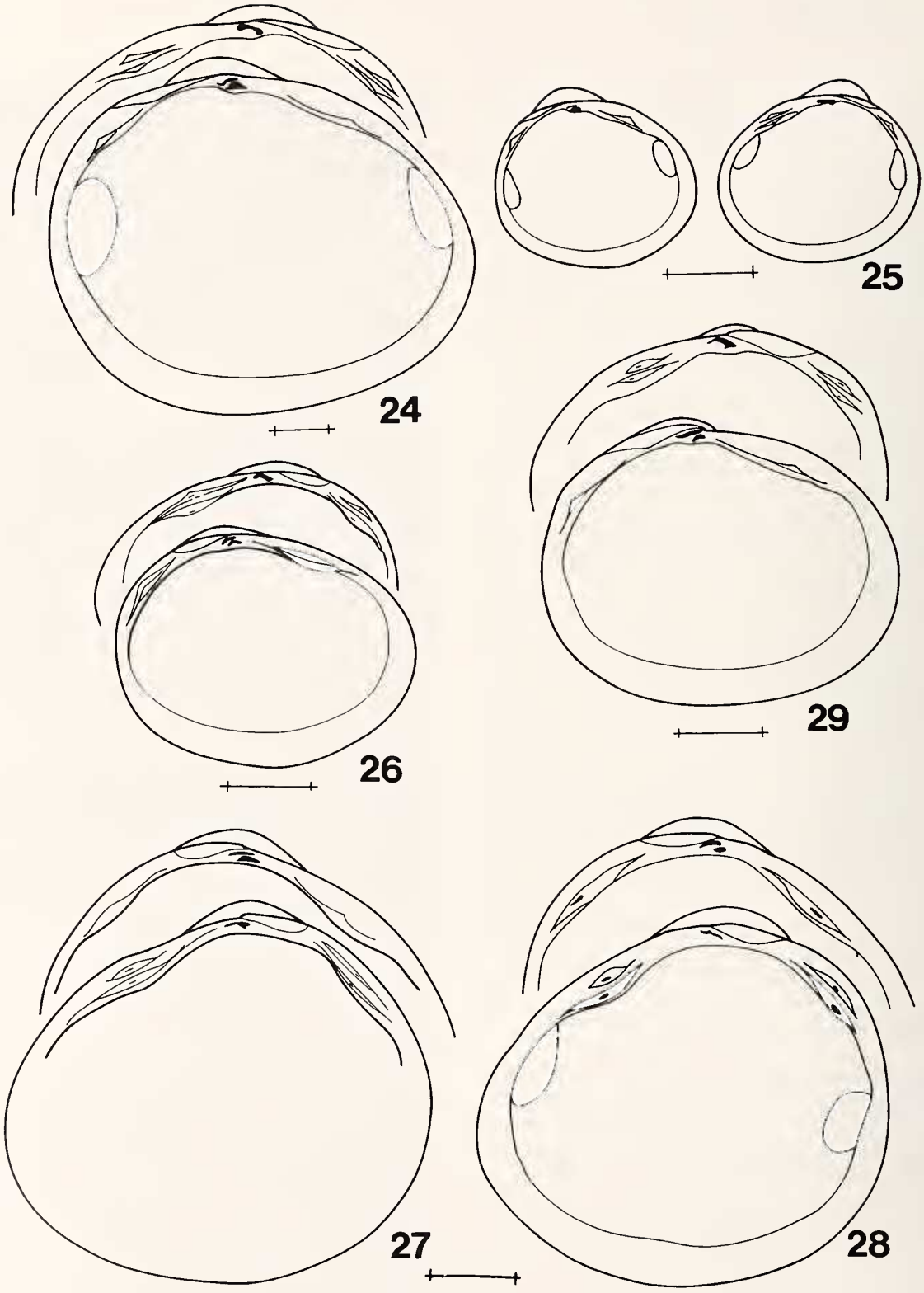
Scacchia plenilunium Melvill & Standen, 1907:150, figs. 20, 20a. Carcelles & Willamson, 1951:339.
Sphaerium vallentinianum Melvill & Standen, 1914:132, pl. 7, figs. 3, 3a, 3b.
Pisidium plenilunium (Melvill & Standen), Dell, 1972:26, fig. 34.

Description of the two syntypes: (RMS 1921.143.724). Shell rounded-ovate, very high and moderately convex (I H/SL = 91.4 and 89.2; Ci = 65.9 and 60.6). Periostracum white-yellowish, shell semi-translucent, densely punctuated, surface finely striated. Shell not very inequilateral, posterior end truncated, anterior end somewhat produced and narrow. Postero-ventral angle of shell is withdrawn

→

Figures 20–23

Paratype of *Pisidium* ***inacayali*** Ituarte, sp. nov. (MLP 5067). Figure 20. Hinge of the right valve. Figure 21. Detail of the right cardinal tooth and ligament. Figure 22. Hinge of the left valve. Figure 23. Left cardinal teeth and ligament. Scale bars = 1 mm.



Figures 24–29

Argentine species of *Pisidium*. Figure 24. *P. sterkianum* from Buenos Aires (MLP 5061). Figure 25. *P. vile* from Buenos Aires (MLP 5062). Figure 26. *P. magellanicum* from Chubut (MLP 5064). Figure 27. *P. observationis* from Neuquén (MLP 5065). Figure 28. *P. patagonicum* from Santa Cruz (from type-series ANSP 88810). Figure 29. Holotype of *P. **inacayali*** Ituarte, sp. nov. (MLP 5066). Scale bars for all figures = 1 mm.

forward. Beak low, moderately visible above dorsal margin, slightly displaced backward (located at 53.8 and 56.8% of shell length), nepionic shell well marked by a dark line, but not inflated.

Hinge plate solid, broadened in central part. Hinge line sharply arcuate, relatively long (HiL/SL = 57.6 and 61.6). Left cardinal teeth: outer (C_4) somewhat oblique, slender, evenly curved, overlapping C_2 at nearly its entire length. C_2 shorter, slender, and slightly curved. Left lateral teeth short, cusp of (A_{II}) stippled, somewhat distally displaced; $P_{(II)}$ lower, cusp wide and rounded. Right cardinal tooth (C_3) low, slender, weakly curved, and thickened at posterior end. Lateral teeth well developed, very short. Anterior and posterior outer laterals reduced, half as long as inner ones. Ligament internal, rather long (representing, in the two syntypes, 21.5 and 20.3% of SL). Ligamental pit broad, ventral margin uniformly curved. Although soft parts have not been preserved in type lot, analysis of dried remains adhered to valves revealed the presence of only one siphonal aperture.

Type locality: Cape Pembroke, Malvinas islands (Scottish Antarctic Expedition 1902–1904, Station 118). Syntypes: one single valve and one complete shell, at the Royal Museum of Scotland, lot. nos. 1921.143.724.

Remarks: This species was originally described in a marine genus from valves collected from the marine shore. Undoubtedly, the authors failed to recognize the freshwater origin of the shells. Dell (1972) assigned the species to the genus *Pisidium* including *Sphaerium vallentinianum* Melvill & Standen, 1914, from Roy Cove, also Malvinas islands, in a synonymic list.

The original description is vague and not sufficient to assign certainly any specimen to this species. Dell (1972) did not give the description of the syntypes lodged at the Royal Museum of Scotland, but figured a right valve, suggesting the possibility that *P. plenilunium* and *P. magellanicum* were synonymous. However, taking into account the striking differences in shell shape—much more rounded, low, and less convex in *P. magellanicum*—this does not seem to be correct. Furthermore, the greater divergence angle of the lateral teeth, which are longer and not remote from cardinals, clearly separates that species from *P. plenilunium*.

In studying the syntypes of *Pisidium plenilunium,* it is evident that the shell outline (high and rounded-oval), the morphometric ratios, the morphology and position of the lateral teeth and beak position, closely approach those of *P. patagonicum* Pilsbry. This taxon may well be synonymous with *P. plenilunium,* but in order to preserve nomenclatural stability, the author postpones any conclusions until future studies allow more complete knowledge about the variability of Patagonian pisidia.

Species of *Pisidium* Doubtfully Distributed in Argentine Inland Waters:

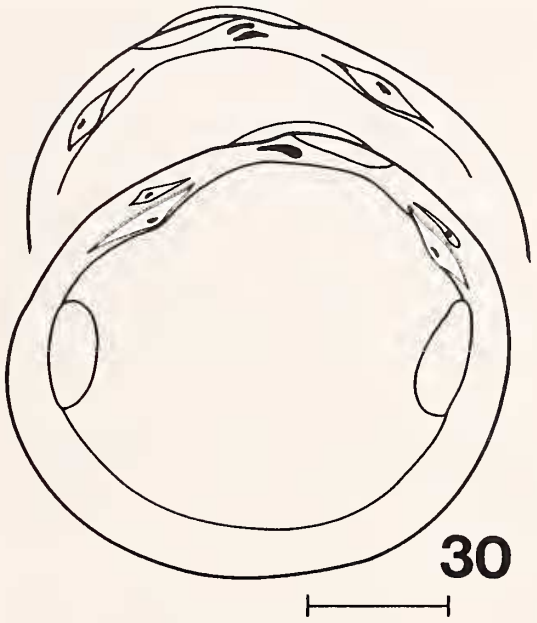


Figure 30

Syntype of *Pisidium plenilunium* (RMS 1921.143.724). Scale bar = 1 mm.

Pisidium dorbignyi (Clessin)

Cyclas pulchella d'Orbigny, 1835:44; 1846:568, pl.83 figs. 8–10
Pisidium dorbignyi Clessin, 1879:62 (*nomen novum pro Cyclas pulchella* d'Orbigny, 1846)
Sphaerium pulchellum (d'Orbigny), Formica Corsi, 1900:1–237

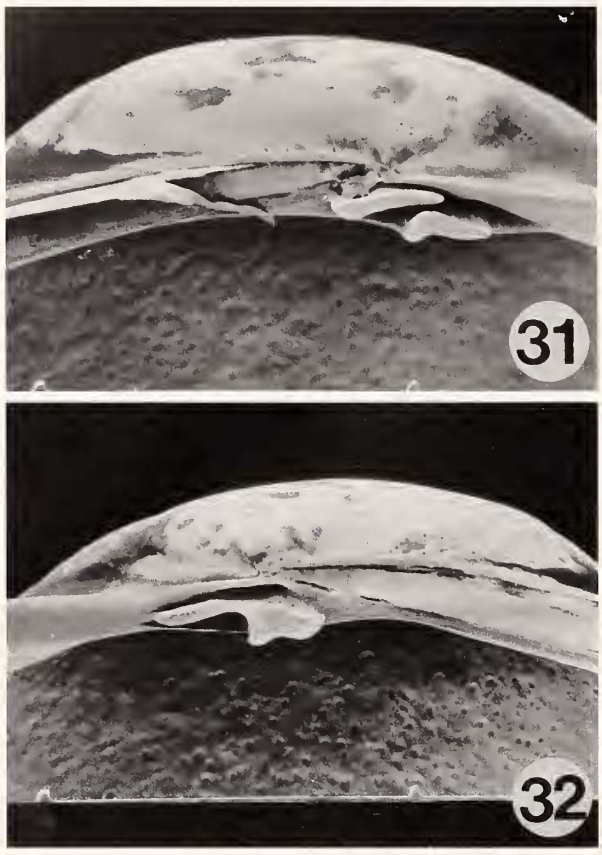
The original description reads (translated): ". . . Shell ovate, inflated, thin, inaequilateral, surface even. Externally olivaceous. 'Buccal' end elongated, rounded; 'anal' end short, obtuse. Interior white. Long. 3 mm . . . ."

Type locality: The type series was collected by d'Orbigny from water reservoirs among sand dunes in the neighborhood of Maldonado, Uruguay.

Other localities: Landoni (1992) reported *P. dorbignyi* from the Río de La Plata and related water courses, but he did not give precise collecting sites. *P. dorbignyi* was also reported from northern Brazil (Lange de Morretes, 1954 *fide* Figueiras, 1965).

Species Formerly Erroneously Quoted as *Pisidium* Species:

Bonetto & Tassara (1987) misquoted *Cyclas paranensis* d'Orbigny, 1846 as a *Pisidium* species from the Paraná river basin. d'Orbigny (1846) included under *Cyclas* the genera *Neocorbicula, Pisidium,* and *Musculium.* His reference to *Cyclas paranensis* actually corresponds to *Neocorbicula paranensis* (d'Orbigny, 1846) (Parodiz & Hennings, 1965; Figueiras, 1965), so *Pisidium paranensis* must be dropped from the *Pisidium* species list.



Figures 31 and 32

Musculium argentinum (MLP 5074). Interior view of right and left valves. Scale bars = 1 mm.

Other Misquoted Pisidia:

Mansur et al. (1991) reported *Sphaerium observationis* Pilsbry, 1911, from Río Grande do Sul, Brazil. Since there is no reason to refer the species to the genus *Sphaerium,* this is an obvious misquotation for *Pisidium observationis.* Furthermore, the occurrence of *P. observationis* in southern Brazil seems to need confirmation.

Some Remarks on the Argentine Species of *Pisidium*:

Attempts to define a natural subgeneric classification of the genus *Pisidium* have not been successful to date. As stated by Kuiper (1983), neither of the proposed subgeneric classifications proved to be valid for more than a very limited geographic region, and probably, further knowledge on soft anatomy, reproductive biology, and life histories is needed to determine a more appropriate system.

Kuiper's (1962) criteria—the occurrence of only one pair of gills, the lack of an anal opening, and the presence of an external ligament—suggest assignment of *P. sterkianum* and *P. vile* to the Ethiopic species group *Afropisidium* Kuiper, 1962, defined as a subdivision of the subgenus *Neopisidium* Odhner, 1921.

All Patagonian species of *Pisidium* here reported have an internal ligament. Among these, *P. magellanicum* is the only species, until now, for which the presence of two branchial openings and two demibranchs (the outer extremely reduced or vestigial) has been determined. The characteristics mentioned above indicate assignment of *P. magellanicum* to the subgenus *Cycladina* Clessin, 1871, a mainly Holarctic group with numerous species in the Southern Hemisphere (Kuiper, 1962). *P. observationis* and *P. **inacayali*** have an enclosed ligament and only one siphonal aperture (the anal) and one (the outer) demibranch, belonging, based on these features, to the subgenus *Neopisidium* Odhner, 1921 (a group, however, which includes small species).

The lack of knowledge of anatomical features for the remaining Patagonian species with internal ligament does not allow us to assign them to any of the proposed subgenus.

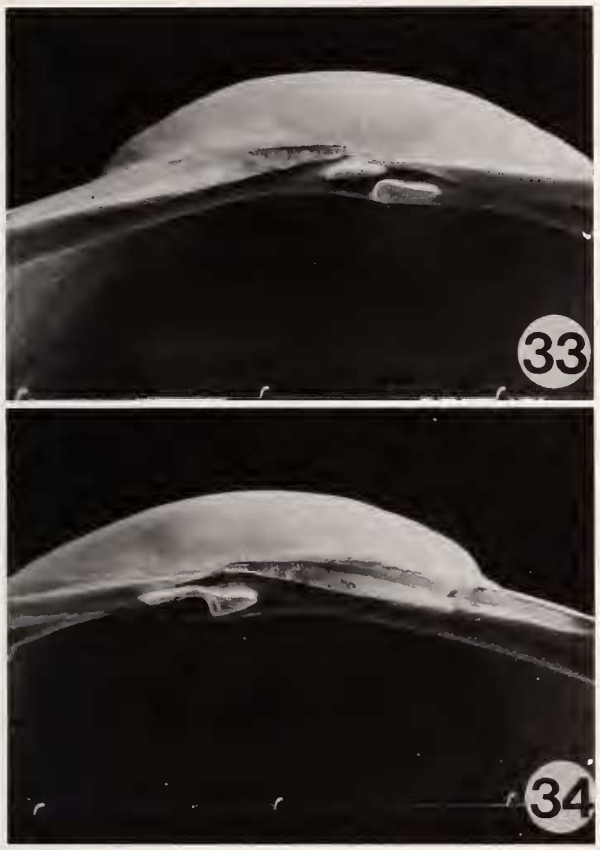
With regard to shell morphology, *P. observationis, P. patagonicum,* and *P. plenilunium* are characterized by a high shell, a centrally placed beak; a narrow anterior end, which is moderately protruded in a more or less sharp curve, and a very short posterior end. The anterior margin is oblique, the dorsal margin short, determining a shell outline which tends to a trigonal profile. Lateral teeth are short and more or less remote from the cardinal. The divergence angle between anterior and posterior laterals is low, no more than 105°. The remaining two species, *P. magellanicum* and *P. **inacayali,*** have lower shells, a rounded-oval shell outline, a very low and backward displaced beak, and a higher divergence angle between lateral teeth (up to 110° as a rule).

Musculium argentinum (d'Orbigny)

(Figures 31, 32, 35, 36)

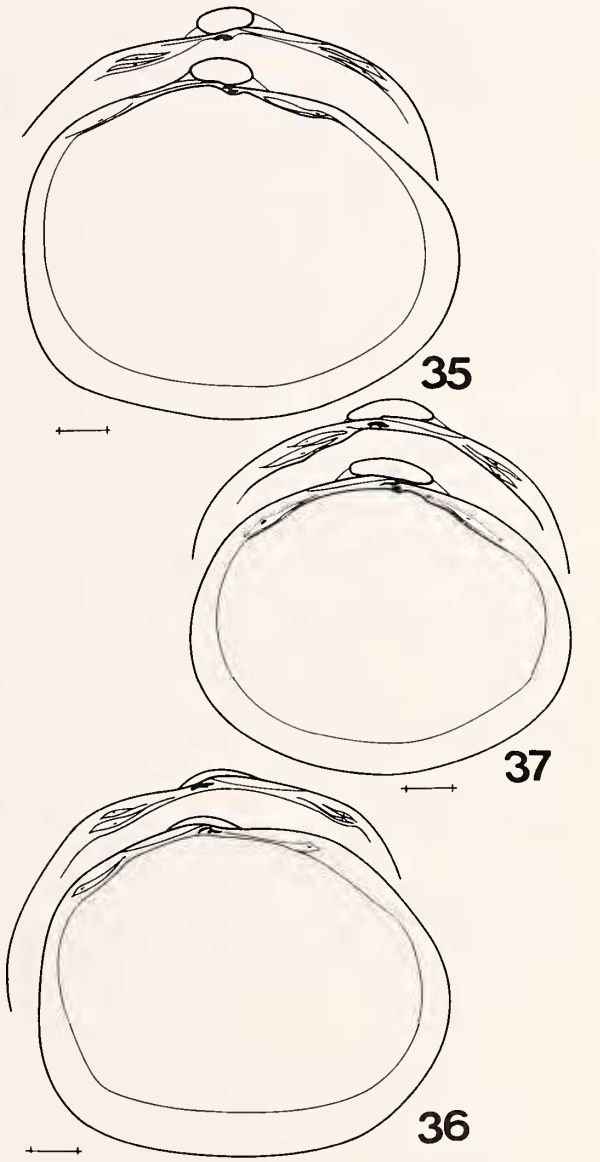
Cyclas argentina d'Orbigny, 1835:44. d'Orbigny, 1846:568, pl. 83, figs. 5–7.
Sphaerium argentinum (d'Orbigny), Strobel, 1874:77.
Musculium argentinum (d'Orbigny), Pilsbry, 1911:605, pl. 46a, figs. 6–7a.

Description: Shell medium-sized to large (maximum size 12.6 mm in shell length), high, rather inequilateral, and moderately convex (average I H/L = 84 ± 2.6; average Ci = 62.4 ± 3.6). Shell outline quadrangular or sharply trapezoidal, dorsal margin quite extended, as large as ventral one; slightly arcuate or straight and broken in middle, just below beak. Dorsal margin connected with anterior and posterior margins by marked angles (sometimes smoothed). Anterior end projecting in markedly obtuse angle or sometimes rounded. Posterior end truncated, somewhat oblique, nearly straight. Beak median, prosogyrous. Prodissoconch minute (1.5–2 mm), inflated in marked nepionic cap. Beak projecting from shell surface to variable degree. In the typical form (Figure 35), lateral shell surface shows sharply marked median triangular hump arising from wide base and tapering to embryonic



Figures 33–34

Musculium patagonicum (MLP 5077). Hinge plates of the right and left valves. Scale bars = 1 mm.



Figures 35–37

Argentine species of *Musculium*. Figure 35 (MLP 5092). Specimen of *M. argentinum* with markedly trapezoidal shell outline, very narrow hinge plate, and prominent beak. Figure 36 (MLP 5071). Specimen of *M. argentinum* with lower beak and more solid hinge plate. Figure 37. *M. patagonicum* from Chubut (MLP 5077). Scale bars for all figures = 1 mm.

cap. In other specimens, beak is not so full, quadrangular appearance is smooth, and shells flatter (Figure 36).

Hinge line straight at anterior half, slightly curved at posterior one. Hinge plate extremely narrow in specimens with full and projected beak (cardinal teeth overhangs at inner margin of hinge). In specimens with lower beak, hinge plate is more solid, but always delicate. Hinge: two slender left cardinals, outer (C_4), oblique, slightly arcuated, thickened at posterior end, inner (C_2), shorter, higher, somewhat displaced forward, sharply curved at posterior half. C_4 overlapping C_2 at posterior end. Lateral teeth remote from cardinals. Anterior lateral (A_{II}) upward arcuate, triangular; cusp distally displaced to antero-dorsal angle. Posterior lateral (P_{II}) slightly curved downward, cusp distally displaced toward postero-dorsal angle. Right cardinal tooth (C_3) straight, broadening backward in small, sulcated, bell-shaped head. Lateral teeth rather short, straight, always low. Anterior laterals (A_I and A_{III}) curved upward, more developed than posterior ones (P_I and P_{III}). Divergence angle between lateral teeth always higher than 140°. Hinge length is about 58% of shell length, with maximum and minimum values ranging from 51% to 62%.

Ligament long (representing about 20% of shell length) and narrow, extending from beak to short distance from beginning of posterior laterals. Ligament externally visible, not projecting above shell surface.

Variability. M. argentinum shows variation in shell outline (Figures 35, 36), convexity of shell (more convex in specimens with marked trapezoidal shell outline), degree of beak prominence (more marked in trapezoidal forms),

and solidness of hinge plate (more solid in forms lacking accentuated contour). Morphology of cardinal teeth is also a variable characteristic which encompasses other variable features: C_3 may be more or less arcuate and, consequently, C_2 and C_4 more or less close to one another.

The range of morphological and morphometric variation has not been described up to date. Because of this, Pilsbry (1911) considered d'Orbigny's (1846) figures (pl. 83, figs. 5–7) of *M. argentinum* as very unsatisfactory. Certainly, d'Orbigny's figure corresponds to an individual without an accentuated trapezoidal outline and without full beaks. The topotypes studied and figured by Pilsbry (1911) correspond to the form here called typical, shown in Figure 35.

Remarks: *M. argentinum* differs from *M. patagonicum* Pilsbry, 1911, in being sharply quadrangular or trapezoidal in shell outline, with the posterior end bluntly truncated, and in having full beaks. The hinge plate is always less solid, and the hinge line always nearly straight or weakly curved. The ratio Hinge Length/Shell Length tends to be constantly greater in *M. argentinum*. In Pilsbry's (1911) opinion, the teeth are decidedly more delicate and compressed than in *M. patagonicum*

Type locality: A brook at the bottom of the Cerro ("arroyo Pantanoso" *fide* Figueiras, 1965), Montevideo, Uruguay.

Other localities: Argentina: Mendoza province: San Carlos; Buenos Aires province: Bahía Blanca, Carmen de Patagones, (Strobel, 1874); arroyo del Azul, Azul (MLP 5073); arroyo Primera Estancia, Magdalena (MLP 5074, 5075); Río Santiago, Ensenada (MLP 5071, 5076); arroyo Miguelín, Ensenada (MLP 5069, 5070, 5072); río Quequén (MLP 5055); Laguna Cami, Tierra del Fuego (MLP 5016).

Musculium patagonicum Pilsbry

(Figures 33, 34, 37)

Musculium patagonicum Pilsbry, 1911:605, pl. 46a, fig. 8, pl. 47, figs. 1–7.

Description: Shell medium-sized to large, fragile, slightly inequilateral. Moderately inflated (average I H/SL = 82.3 ± 1.7; average Ci = 66.3 ± 4.2). Surface glossy, straw-yellowish, somewhat olivaceous, sometimes changing to grey violaceous. Interior bluish. Shell outline from subquadrangular, with no marked angles, to rounded-oval. Dorsal and ventral margins about equally curved. Anterior end slightly protruded, evenly curved or very slightly angled. Posterior end weakly truncated; ventral margin always uniformly curved. Shell outline of half-grown specimens tending to be more trapezoidal. Beak prosogyrous, median, wide, not full, with well-marked embryonic cap.

Hinge plate rather solid, hinge line arched, relatively long (hinge length is about 58% of shell length, ranging from 53% to 68%. Hinge: left valve, cardinal teeth delicate, outer cardinal (C_4) a slender lamella, somewhat oblique, inner one (C_2) short, acute, displaced forward with respect to C_4. Lateral teeth rather close to cardinals, slender, triangular and relatively short, cusps median to distal. Right valve: one low cardinal tooth (C_3), nearly straight, posteriorly thickened and sulcated, sometimes showing a median sinking separating anterior and posterior ends. Anterior lateral teeth low, slender. Inner lateral (A_I) slightly curved, with distal cusp; outer lateral (A_{III}) strongly reduced, low, displaced backward. Posterior laterals (P_I and P_{III}) low, nearly straight. Maximum divergence angle between lateral teeth: 130° (more frequent values were: 120°–130°). Ligament externally visible but not protruding. Ligamental pit relatively long and uniformly narrow, pointed at both ends (ligament length is about 20% of shell length).

Variability. Among different lots, the shell shape may be more or less subquadrangular. The shell height represents about 81–83% of the shell length, varying slightly according to the origin of the lots. The shell diameter shows greater dispersion in values and represents about 55–66% of shell height.

Remarks: *M. patagonicum* is similar to *M. argentinum*, from which it differs in having a smaller maximum size, less relative height, and larger diameter. The beak is not as full, and the shell outline is never markedly trapezoidal as in *M. argentinum*; the posterior margin is less abruptely truncate (especially in larger specimens), and the shell outline not sharp-cornered as is typical for *M. argentinum*. The hinge plate is always more solid than in *M. argentinum*. The divergence angle of lateral teeth is constantly lower than in *M. argentinum*. The upper margin and the hinge line are curved, never straight or a broken line as in *M. argentinum*. The morphometric ratios of both species are very close.

Type locality: Santa Cruz province: río Chico, 50 miles above the Sierra Oveja (today: cerro Las Ovejas, 48°46′S; 70°22′W), department of Río Chico (ANSP 88807).

Other localities: Santa Cruz province: many springs along the río Chico, 15, 25, 30, y 35 miles above the Sierra Oveja (Pilsbry, 1911) (ANSP 88808 and 88809 lots were studied); Las Horquetas, Rio Coyle (MLP 5056); Lago San Martín (MLP 5057); arroyo Chico, Rio Gallegos (MLP 5053); Calafate, Lago Argentino (MLP 5083). Chubut province: arroyo Nant y Fall, national Road 259 between Trevelin and the Andean cordilleran pass toward Futaleufú (MLP 5077); unnamed brook, national road 258, 13 km before Cholila (MLP 5079); unnamed brook 3 km from Trevelín at the road to Futaleufú Lake Dam, Esquel (MLP 5078). Neuquen province: Laguna Negra (975 m elevation) between Lago Hermoso and San Martín de los Andes, province of Neuquen (MLP 5080).

ACKNOWLEDGMENTS

I wish to express my gratitude to Lic. Guido Pastorino (Museo de La Plata) and Lic. Manuel Quintana (Museo Argentino de Ciencias Naturales "Bernardino Rivada-

via"), for their valuable help during the development of this study. The kind cooperation obtained from Dr. G. Rosenberg and Dr. D. Bardes (Academy of Natural Sciences of Philadelphia), and Dr. D. Heppell (Royal Museum of Scotland) is especially acknowledged. Dr. B. Roth and an anonymous reviewer made useful suggestions on the manuscript.

LITERATURE CITED

Bonetto, A. A. & M. P. Tassara. 1987. Contribución al conocimiento limnológico de moluscos pelecípodos en la cuenca del plata, con particular referencia a sus relaciones tróficas. Ecosur 14–15 (25–26):17–54.

Clessin, S. 1871. Zur Kenntnis unserer Pisidien. Malakozoologische Blatter p. 184.

Clessin, S. 1879. Die Familie der Cycladen. Martini & Chemnitz in Systematisches Conchylien Cabinet 9(3). 282 pp, 46 pls.

Carcelles, A. & S. I. Williamson. 1951. Catálogo de los moluscos marinos de la Provincia Magallánica. Revista del Instituto de Investigaciones de las Ciencias Naturales, Zoología 2(5):225–383.

Dall, W. H. 1908. Report of the scientific results of the expedition "Albatross." Mollusca and Brachiopoda. Bulletin of the Museum of Comparative Zoology 43:205–487.

Dell, R. K. 1972. Notes on nomenclature of some Mollusca from Antarctica and southern South America. Records of the Dominion Museum 8(3):21–42.

d'Orbigny, A. D. 1835. Synopsis terrestrium et fluviatilium molluscorum, in suo per American meridionalem itinere, ab A. d'Orbigny, collectorum. Magasin de Zoologie 6(61–62): 1–44.

d'Orbigny, A. D. 1835–1847. Voyage dans l'Amerique méridionale. 5, part. 3, Mollusques. ed. P. Bertrand. Paris.

Fernández, L. & J. A. Schnack. 1977. Estudio preliminar de la meiofauna bentónica en tramos poluidos de los arroyos Rodriguez y Carnaval (provincia de Buenos Aires). Ecosur 4(8):103–115.

Figueiras, A. 1965. La malacofauna dulceacuícola del Uruguay. Parte II: Pelecypoda. Comunicaciones Sociedad Malacológica del Uruguay 1(8):223–270.

Formica Corsi, A. 1900. Moluscos de la República Oriental del Uruguay. Anales del Museo Nacional, Uruguay 2(15–17):1–237.

Holopainen, I. J. & J. G. J. Kuiper. 1982. Notes on the morphometry and anatomy of some *Pisidium* and *Sphaerium* species (Bivalvia, Sphaeriidae). Annales Zoologici Fennici 19:93–107.

Ituarte, C. F. & S. Gordillo. 1991. Nuevas citas de pelecípodos dulciacuícolas de Isla Gable, Tierra del Fuego, Argentina. Neotropica 37(97):29–30.

Kuiper, J. G. J. 1962. Note sur la systématique des Pisidies. Jounal de Conchyliologie 102(2):53–57.

Kuiper, J. G. J. 1983. The Sphaeriidae of Australia. Basteria 47:3–52.

Kuiper, J. G. J. 1991. De Atlantische verspreidingsbarrière, een niet-meetbare parameter in de systematiek der Sphaeriidae. Correspondentieblad van de Nederlandse Malacologische Vereniging 263:917–924.

Landoni, N. A. 1992. Inventario de los moluscos de agua dulce de la Provincia de Buenos Aires. Situación ambiental de la Provincia de Buenos Aires. A. Recursos y rasgos naturales en la evaluación ambiental n°17, C.I.C. provincia Buenos Aires. 57 pp.

Mansur, M. C., C. Schulz, M. G. Oliveira da Silva & N. M. R. Campos-Velho. 1991. Moluscos Bivalves limnicos da estaçao ecológica do Taim e áreas adjacentes, Rio Grande, Brasil. Iheringia, Sér. Zoologica 71:43–58.

Meier-Brook, C. 1967. *Pisidium forense,* a new species from Brazil (Mollusca, Eulamellibranchiata, Sphaeriidae). Archiv für Hydrobiologie 64(1):63–68.

Melvill, J. C. & R. Standen. 1907. The marine Mollusca of the Scottish National Antarctic Expedition. Transactions of the Royal Society of Edinburgh 46(5):119–157, 1 pl.

Melvill, J. C. & R. Standen. 1914. Notes on Mollusca collected in the North West Falklands by Mr. Rupert Vallentin, F. L. S., with descriptions of six new species. Annals and Magazine of Natural History 8(13):109–136, 7 pla.

Odhner, N. H. 1921. On somes species of *Pisidium* in the Swedish State Museum. Journal of Conchology 16(7):218–223.

Olazarri, J. 1983. *Biomphalaria tenagophila* (d'Orbigny, 1835) (Moll. Gastr.) en la zona de Salto Grande. IV. Fauna de posible relación con sus poblaciones. Comunicaciones de la Sociedad Malacológica del Uruguay 6(45):131–163.

Parodiz, J. J. & L. Hennings. 1965. The *Neocorbicula* (Mollusca: Pelecypoda) of the Paraná-Uruguay basin. Annals of the Carnegie Museum 38(3):69–96.

Pilsbry, H. A. 1897. New species of mollusks from Uruguay. Proceedings of the Academy of Natural Sciences of Philadelphia, May 1897:290–298, 2 pla.

Pilsbry, H. A. 1911. Non-marine Mollusca of Patagonia. Reports of the Princeton University Expedition to Patagonia (1896–1899) 3(5):513–633.

Pilsbry, H. A. 1924. South American land and freshwater mollusks. Proceedings of the Academy of Natural Sciences of Philadelphia 76:49–66, 4 pla.

Strobel, P. 1874. Materiali per una Malacostatica de terra e di acqua dolce dell' Argentina. Biblioteca malacologica, Vol. 4. Pisa.